

WASHINGTON

SCIENCE TRENDS

HIGHLIGHTS

- NUCLEAR TESTING
- U. S. GROUND EFFECT MACHINE PACT
- ELECTRIC DISCHARGE FORMING
- TECHNICAL TRENDS
- NAVY HYDRAULIC REQUIREMENTS
- RESEARCH CHECKLIST
- PUBLICATION CHECKLIST

Volume VI, No. 25

September 4, 1961

* NUCLEAR TESTING

The Soviet decision to announce a resumption of nuclear testing is considered to be a blunder by U. S. officials. However, these aspects may be worthy of more detailed consideration:

✓ The years which have passed since U. S. nuclear testing was halted have been devoted to an intensive investigation of ways and means of detecting and analyzing foreign nuclear tests. In connection with the Geneva conferences, the Soviets have been made well aware of U. S. capabilities in this field.

✓ U. S. officials presume that the Soviets have arrived at a point in their nuclear weapons program where tests in the "open" or in the atmosphere were deemed necessary by Soviet military authorities.

✓ Soviet officials, therefore, aware of our detection capabilities, have apparently decided that the announcement of a resumption of testing, while temporarily damaging to prestige, would be preferable to a U. S. announcement of Soviet tests -- which could come at any time in the very near future.

✓ The U. S. may temporarily forego nuclear testing of weapons as a means of making the most of a propaganda advantage. However, preparations for underground tests for a variety of peacetime applications have been going forward at an accelerated rate in recent months. Detection of actual Soviet explosions could be followed by a U. S. announcement of "peaceful" tests, perhaps with an invitation to foreign observers to witness the experiments and share in the findings. However, U. S. military authorities can be presumed to be as anxious as their Soviet counterparts to test the untried warheads of various U. S. strategic and tactical weapons.

(For further information on preliminary U. S. plans see Washington SCIENCE TRENDS, July 24, 1961)

* U. S. NEGOTIATING GROUND EFFECT MACHINE CONTRACT

The Maritime Administration, acting on proposals submitted to the Navy's Office of Naval Research, is negotiating a contract for the design and possible future development of a large ground effect machine for ocean, coastal and inland water transportation. The device, working on the now-familiar "cushion of air" principle, is termed a "surface-effect" craft by the Maritime interests.

Vehicle Research Corp., Pasadena, Calif., with Douglas Aircraft Co., El Segundo, Calif. as major subcontractor, will be asked to submit design estimates for vehicles in the 50-to-200-ton class. A 100-ton craft would probably be some 142 in length, 76 feet in width with 22,000 horsepower (presumably gas turbines) capable of lifting and propelling the craft at more than 100 knots with a 46 ton payload. The proposed design program will also provide for extensive model tests to determine high sea performance. Included will be powered scale model tests in high waves.

* ELECTRIC DISCHARGE FORMING

A 17-month investigation leads National Aeronautics and Space Administration engineers to believe that the relatively new process of electric discharge forming "is one of the most promising and practical means of forming large bulkheads in either one piece or with a minimum number of welds."

- ✓ Background: Studies at NASA's Huntsville, Ala. facilities have centered upon possible space applications for this technique, which utilizes extremely rapid discharge of voltage from a capacitor bank, through an ionization or high voltage carrier switch into an explodable titanium bridge wire. The explosion of the wire, with the overload of current, sends a resultant shock wave through the medium of water to form metal into a concave-shaped die.
- ✓ Facilities: A chamber currently being used to form five and ten inch diameter sample hemispherical bulkheads is approximately 18 inches in diameter and 36 inches in depth. Current, ranging up to 20,000 amperes, is provided from a 20,000 volt capacitor bank. Technicians are building a larger unit -- seven feet in diameter and 36 inches in depth -- which will use energy from a 240,000 joule capacitor bank, for more detailed investigations.
- ✓ Applications: NASA is particularly interested in this process for the development of fuel and oxidizer tank bulkheads in excess of 300 inches diameter which may be required for the large Saturn C-3 and Nova planetary exploration vehicles. No industrial organization is reportedly equipped at this time to fabricate one-piece bulkheads larger than 200 inches in diameter.

At the present time, bulkheads for the smaller Saturn C-1 vehicles are formed by hydrospinning -- a process which features a large spinning mandrel or rounded steel die, around which shaped aluminum sheets are formed. The C-1 has eight, 70 inch diameter tanks and a single 105 inch diameter inner tank. NASA engineers state that the spinning technique "appears to be impractical" for forming extremely large bulkheads. Segmented or sectional bulkhead designs would be feasible but "are not the optimum" since additional welds tend to decrease reliability.

NASA engineers are also testing the feasibility of the electric discharge method for other applications, such as the forming of electrical connections and expanding joints in pipes and tubes.

- ✓ Advantages: Electric discharge forming is said to offer these "distinct advantages" in bulkhead forming:
 - Process is safe, with the forming taking place under easily controlled conditions.
 - Process is compact, requiring only a tank roughly the size of the bulkhead to be formed, or a work coil and attendant capacitor bank.
 - Process is economical, considering both initial and operating costs.
 - Process is practical, in that it can be located at any convenient place.
 - Process is practically maintenance-free, with few moving parts and only routine checks of electric wiring and connections required.

(Studies by the Fabrication and Assembly Engineering Division, Measurements and Instrumentation Development Section, George C. Marshall Space Flight Center, NASA, Huntsville, Alabama)

* NBS DROPS CELL MEASUREMENT SERVICE

The National Bureau of Standards has discontinued the certification of electromotive force (emf) of unsaturated standard cells, which are used by power companies and instrument calibrating laboratories as a reference emf with potentiometers. The Bureau says such services are now "adequately available" at commercial laboratories. However, NBS will continue its certification services for saturated cells.

TECHNICAL TRENDS

- Advanced Research Project Agency, Pentagon, Washington 25, D. C. is beginning to plan sponsored research projects in guerilla-type warfare, or "Remote Area Combat" under its new "Project Agile". ✓✓ The General Services Administration will accept bids until November 27, 1961 for a 78-acre aircraft plant formerly operated by the Martin Co. at Bengies, Md. ✓✓ A revised "Handbook for Contamination Control of Liquid Rocket Propulsion Systems" is now available at \$1 from Aerospace Industries Association, (ATTN: G. S. Garrard) 610 Shoreham Building, Washington 5, D. C. ✓✓ Information on proposed improvements in commercial standards for automotive lifts is available as Publication CS142-58 from Commodity Standards Division, U. S. Department of Commerce, Washington 25, D. C. ✓✓ The Information Office, U. S. Atomic Energy Commission, Washington 25, D. C. has available Announcement IN-246 outlining 28 new and 67 renewed physical research contracts.
- A survey of the lead industry in 1960 is available as Mineral Market Report MMS No. 3272 from Branch of Nonferrous Metals, Division of Minerals, U. S. Bureau of Mines, Washington 5, D. C. ✓✓ Cornell Aeronautical Laboratory, Buffalo, N. Y. is undertaking a survey for the Air Force on the "men, money and materials" currently invested in Bioastronautics research throughout the nation. ✓✓ The Army has estimated that it will require 40,000,000 pounds of aluminum sheet and plate for its tank-automotive program in the current Fiscal Year. Under "normal" conditions this could increase to some 70,000,000 pounds by Fiscal Year 1965. ✓✓ The Safety Regulations Divisions, Federal Aviation Agency, Washington 25, D. C. has available information on a September 11 conference called to consider "preliminary" proposed revisions to regulation governing the performance and operation of turbine-powered transport planes. ✓✓ Information on services in the calibration of optical pyrometers, used to measure the brightness temperature of incandescent objects, is available from the National Bureau of Standards, Office of Technical Information, Washington 25, D. C.
- The U. S. Bureau of Mines will open bids September 8, 1961 for a facility to house a 155,000-curie cobalt-60 source to be used at Albany, Ore. in studies of gamma radiation effects on coal, petroleum, and metallic and nonmetallic minerals. ✓✓ The National Science Foundation has signed a \$42,389 contract with the John I. Thompson Co., Washington, D. C. for a study of the Government's r&d report distribution system. The study will presumably include the virtually non-existent system of the NSF. ✓✓ Confirming previous reports in Washington SCIENCE TRENDS, the Navy has begun the launching of space probes, and eventually satelloids, over the Pacific Missile Range using a F4D aircraft as a "booster" and a Sparoair two stage unguided rocket utilizing two Sparrow missile rocket motors. An experimental probe in mid-July reached an altitude of more than 64 miles, with a 35-pound payload. ✓✓ The Research Analysis Corp. has been formally established at Bethesda, Md. as a successor to the Operations Research Office operated for many years for the Army by Johns Hopkins University -- until personality conflicts intervened.
- The Federal Aviation Agency has type-certificated Lockheed's "compact" Jet Star. ✓✓ FAA is scheduling an industry-Government airworthiness Conference in Washington, December 5 & 6, 1961 for discussion of technical problems associated with a supersonic transport. A reference document to be used at the meeting is available free from the FAA Flight Standards Service, Washington 25, D. C. Ask for "Supersonic Transports--A Preliminary Study of Standards for Airworthiness, Operations and Maintenance." ✓✓ National Aeronautics and Space Administration has confirmed that it plans to expand its Ranger spacecraft program from five to nine launchings. RCA Astro Electronics Division, Princeton, N. J. has been chosen to develop the high resolution television system expected to transmit lunar surface pictures. ✓✓ Hamilton Standard Division of United Aircraft will soon begin tests of prototype models of a carbon dioxide control system utilizing zeolite, a solid adsorbent material.

* NAVY SEEKS HYDRAULIC INNOVATIONS

Here are some of the areas of improvement sought by the Navy to provide improved transmissions for hydraulic winches and many other applications:

- ✓ Development of a compact, full-flow filter for the active hydraulic system.
- ✓ Development of a control that will provide a constant torque output regardless of load on the transmission. Torque output should be readily adjustable over a wide range. For winch applications, this would be automatic tensioning.
- ✓ Further simplification of a completely closed system, through elimination of presently required servo and replenishment pump.
- ✓ Development of improved material that will defy contamination.
- ✓ Reduction in the size and weight of 75-horsepower and larger hydraulic transmissions, through the use of increased operating pressures and transmission speeds.
- ✓ Combining the improvements listed above into a factory-sealed transmission which would permit quick removal and installation of a spare unit in the field.

(Requirements reported by A. M. Hanke, Replenishment-at-Sea and Boat Handling Section, Code 632, Bureau of Ships, U. S. Navy, Washington 25, D. C.)

* CAN RADIATION LENGTHEN LIFE?

The Atomic Energy Commission has published a statistical analysis indicating that low levels of chronic exposure to penetrating nuclear radiation "have the effect of lengthening life."

No attempt is made in the study, by H. F. Henry of the Oak Ridge (Tenn.) Gaseous Diffusion Plant, to attribute any particular cause to "this apparent effect", although some biologists have speculated that such radiation might have the effect of reducing infection in early life. There is also some belief that ionizing radiations are actually necessary for the normal existence of living organisms.

The longevity effect, if there is one, is based partly upon the finding that radiologists, who work under constant low-level radiation exposure, have an "apparent greater life expectancy" as compared to physicians in general. These findings are said to gain support from a number of animal studies.

"It is of interest," the AEC report states, "that this longevity effect appears to be much like that produced in the human population by medicines over the past 100 years, in that the average life span has been markedly increased but the maximum has been extended only slightly, if at all."

The studies may point the way to a radiation exposure "threshold" beyond which radiation may be harmful, but below which radiation can have beneficial effects. The new report is in sharp contrast, moreover, to statements made from time to time that "all radiation is harmful."

(Report K-1470, "Is All Nuclear Radiation Harmful?" is available through AEC channels or at 50 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)

RESEARCH CHECKLIST

- TIN RECOVERY: The Bureau of Mines has been investigating several promising systems for recovering tin from troublesome iron-tin alloys by selectively oxidizing the iron. Development of a practical process would eliminate the heavy recycling load presently required in tin-smelting practice. Experiments indicate that such selective oxidation of iron is possible using steam-hydrogen mixtures that fall within the proper composition ranges.
- (Report available. Single Copies Free. Write U. S. Bureau of Mines, Publications-Distribution Section, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigations No. 5756)
- HIGH PRESSURE STUDIES: The U. S. Naval Ordnance Laboratory, White Oak, Md. has developed a new technique to determine -- in a single experiment -- the dynamic compressibility of a solid over a relatively large pressure range. The method can be used for study of the behavior of materials when subjected to shock wave pressures from explosives. The Navy technique consists of observing with a rotating mirror smear camera, the behavior of test material struck by such a shock wave. Tests have been run on aluminum and plexiglas.
- (Details reported in NAVWEPS Report 6026 ((PB 171 686)) available through military channels or at \$1 from OTS, U. S. Department of Commerce, Washington 25, D. C.)
- FIFTH WHEEL FAVORED: Army tests indicate highly favorable results when a fifth wheel is used as a method of steering semitrailers during complicated backing operations. The method making use of the principle of transverse motion, is also said to be adaptable to military-type shuttle tractors or to military tractors. Transportation Corps tests also indicate that the use of a steerable fifth wheel would be much more economical than all-wheel steering and would result in a considerable savings in manpower and time. In addition, many existing vehicles can be converted to fifth-wheel steering.
- (Details available in PB 171 613 available at 50 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)
- MINIATURE BATTERY SYSTEM: The Army has developed a miniature, high voltage battery to maintain charge on a capacitor or for other low-current drain applications. Major efforts were directed toward a stable electrochemical system, adequate cell-to-cell sealing and low temperature operation -- an important objective since miniature high-voltage batteries seldom have this capability. Tests have been satisfactory, but there may be unsuspected manufacturing and applications problems.
- (Details are available in DOFL Report TR-883 ((PB 171 582)) available through military channels or at 75 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)
- WHIP-TYPE ANTENNAE: The Sandia Corp. operating for the Atomic Energy Commission has developed mechanical design analyses for whip-type antennae subjected to a wind environment. The mathematical study considers both deflection and maximum bending stress. The results are considered of importance since, to obtain consistent field patterns and efficient radiation or reception, such an antenna must maintain its configuration within certain limits.
- (Details available in Report SCTM 381-60(14) available through AEC channels or at 50 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)

P U B L I C A T I O N C H E C K - L I S T

- EXPANDABLE SPACE STRUCTURES, a report on hearings concerned with the many possible applications of inflatable and expandable structures in space. 11 Pages. Single Copies Free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D. C. for House Report No. 910)
- POTASSIUM VAPOR PRESSURE, a U. S. translation of a Soviet paper concerned with potassium, pure or in alloy form, with sodium, as a potential heat transfer fluid. 7 Pages. Single Copies Free. (Write National Aeronautics and Space Administration, 1520 H Street, N. W., ATTN: CODE BID, regarding Technical Translation No. F-66)
- EXAMINATION SYSTEM IN THE U. S. PATENT OFFICE, an excellent study prepared by Congress on the examination system in the Patent Office -- one of the major stumbling blocks to reducing the nation's huge patent application backlog. 181 Pages. (Write Subcommittee on Patents, Committee on Judiciary, U. S. Senate, Washington 25, D. C. regarding Patent Study No. 29 -- The Examination System)
- PRODUCTION MELTING FURNACES, a report containing general recommendations on design features for titanium and zirconium production-melting furnaces, prepared by an industry group. 7 Pages. Single Copies Free. (Write Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio regarding DMIC Memorandum No. 116)
- U. S. NAVAL AVIATION, 1910-1960, a well-illustrated historical account on the growth and development of the Navy's air arm, currently observing its 50th anniversary. \$2.50. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. regarding "U. S. Naval Aviation, 1910-60")
- ALUMINUM EXTRACTION, a progress report on techniques for using molten zinc to extract aluminum from aluminum-silicon alloys. 15 Pages. Single Copies Free. (Write Publication-Distribution Service, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. regarding Report of Investigation No. 5781)
- GOVERNMENT ELECTRONIC PUBLICATIONS, a catalog of some of the U. S. Government's many publications dealing with radio, electricity, electronics, radar and communications. 13 Pages. Single Copies Free. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. regarding Price List No. 82)
- NAVY RESEARCH PROBLEMS, a listing and description of the many unclassified research and development problems for which solutions are currently being sought. 78 Pages. Single Copies Free. (Write Chief, Bureau of Naval Weapons, Department of the Navy, Washington 25, D. C., ATTN: CODE RREN-1, regarding NAVWEPS Report 7682 Volume I)
- TRANSMISSION OF LIGHT IN WATER, an annotated bibliography covering world literature on the transmission of light through water, and related properties of water for the period 1818-1959. 88 Pages. (Publication PB 171 133 available through military channels or at \$2.25 from OTS, U. S. Department of Commerce, Washington 25, D. C.)
- RECENT DEVELOPMENTS IN BERYLLIUM, a review of technology in this field for May, June and July, 1961. 3 Pages. Single Copies Free. (Write Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio regarding DMIC Memorandum No. 123)
- CIVIL AVIATION, SOUTHWEST ASIA, a survey of commercial and general flight operations in the area with emphasis on market potential, trade and investment opportunities in U. S. aircraft and aeronautical products. 19 Pages. 15 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Publication No. C 41.96:As 4)

